

## IMAGE FORMING APPARATUS

### BACKGROUND OF THE INVENTION

#### Field of the Invention

5           The present invention relates to an image forming apparatus. More particularly, the invention relates to a portable thin image forming apparatus, which can be driven by use of a battery.

#### Related Background Art

10           The ink jet recording apparatus, which is widely known as an image forming apparatus, has been utilized for a printer and a copying machine, because the apparatus operates with less noise and lower running cost, and can be made compact and adaptable for color  
15 use, among some other advantages.

          Also, in recent years, along with the downsizing of computers, a portable computer of note type and the like have been in wide use. Then, along with this trend, a small image forming apparatus has been  
20 designed with the principal object of providing portability.

          As the requirements of an image forming apparatus for portable use, it has been particularly important that the apparatus can be held (handled) easily; the  
25 apparatus is thin so that it can be held in a bag or the like appropriately; and it should be battery

driven, and easily chargeable, among some others.

To meet such requirements, it has been practiced to market as a product for portable use a thin note type printer, which is used by installing a battery  
5 charger with a battery incorporated therein.

However, in order to avoid taking a large space for storage at the time of non-use, a thin type printer of the kind is placed so as to be substantially vertical (called ❖ vertical placement❖) from the  
10 direction almost in parallel with the plane in which the flat housing of the printer is placed (called ❖ horizontal placement❖), it causes lack of stability, because the apparatus is thin. Therefore, there is a need for handling the printer carefully for the  
15 placement with a good balance or there is a need for another action such as to spread a footing member for enabling the installation area to be expanded for obtaining stability.

Also, when a battery should be charged, a source-  
20 supply cable, such as an AC adopter, is inserted into a printer main body or a charger is mounted on the printer main body. Then, it is necessary to remove the source-supply cable, which has been connected, when the apparatus is carried after electricity has been  
25 charged. The structure is not arranged appropriately to effectuate charging with ease for portable use.

# SUMMARY OF THE INVENTION

The present invention is designed in consideration of the situations as discussed above. It is an object of the invention to provide an image forming apparatus excellent in operability in the storage at the time of non-use, and also, excellent in operability in charging the battery, in addition to such advantages as thin and battery-driven, and preferably suitable for portable use.

In order to achieve the aforesaid object, the image forming apparatus of the present invention is made capable of being contained in a separate container stand (hereinafter referred to as a ~~cradle~~) serving as a placement stand.

The image forming apparatus is used in a mode of horizontal placement at the time of forming images, and capable of being contained in a mode of vertical placement at the time of non-use adopting the mode having the apparatus to be contained in the cradle.

The image forming apparatus further comprises a battery, and charging means for charging the battery, and it is preferable to conduct the charging of the battery by containing the apparatus in the cradle at the time of non-use.

The battery and the charging means are

incorporated in a charging device structured to be attachable to and detachable from the image forming apparatus, and it is preferable to conduct the charging of the battery by containing in the cradle the charging  
5 device in the status of being mounted on the image forming apparatus.

On the backside of the charging device, the contact point portion is provided, and the contact terminal portion is provided for the cradle, and it is  
10 preferable to connect the contact point portion and the contact terminal portion electrically by containing the image forming apparatus having the charging device mounted thereon in the cradle.

The contact point portion of the charging device,  
15 and the contact terminal portion of the cradle are arranged in the central portion of the connecting surface of the charging device and the cradle, respectively, and are preferably are in a symmetrical mode.

20 The aforesaid cradle is provided with a shutter mechanism for protecting the contact terminal portion, and it is preferable to retract the shutter mechanism by containing in the cradle the image forming apparatus having the charging device mounted thereon.

25 It is preferable to make the load required for pressurizing the contact terminal portion to be in

contact and retracting the shutter mechanism smaller than the weight of the charging device alone.

For the image forming apparatus, the charging device is provided with a portion to hide the DC jack  
5 for input use, and when the image forming apparatus having the charging device mounted thereon is contained in the cradle, the structural portion of the cradle preferably covers the jack for DC input use of the charging device.

10 Also, in place of the mode of the image forming apparatus described above, it may be possible to incorporate the battery in the image forming apparatus, and the charging means is incorporated in the cradle, and the battery is charged when the image forming  
15 apparatus is contained in the cradle.

In another mode described above, it is preferable that on the backside of the image forming apparatus the contact point portion is provided, and the contact terminal portion is provided for the cradle, and the  
20 contact point portion and the contact terminal portion are electrically connected by containing the image forming apparatus in the cradle.

In another mode described above, it is preferable that the contact point portion of the image forming  
25 apparatus and the contact terminal portion of the cradle are arranged in the central portion of the

connecting surface of the charging device and the cradle, respectively, and are in a symmetrical mode.

In another mode described above, it is preferable that the cradle is provided with a shutter mechanism  
5 for protecting the contact terminal portion, and the shutter mechanism retracts by containing the image forming apparatus in the cradle.

In this case, it is preferable to make the load required for pressurizing the contact terminal portion  
10 to be in contact and retracting the shutter mechanism smaller than the weight of the image forming apparatus.

Also, each of image forming apparatuses of various modes described above is provided with indication means for showing the charging condition of the battery  
15 either for the charging device or the image forming apparatus, and it is preferable to structure the indication means to be recognizable even when the image forming apparatus is contained in the cradle.

It is also preferable to make the indication means  
20 for showing the charging condition of the battery recognizable even when the image forming apparatus is contained in the cradle in any direction, forward or backward, and to make the contact point portion and the contact terminal portion electrically connectable.

25 It is preferable to structure a recording sheet supply tray, which dually functions as a cover capable

of being open and closed with respect to the image forming apparatus, not to open when the image forming apparatus is contained in the cradle.

It is preferable to make the image forming  
5 apparatus containable in the cradle in the status of having an I/F cable connected thereto.

It is preferable to arrange on the inner floor surface of the cradle the elastic member that supports the feet of the charging device or image forming  
10 apparatus to be contained in the cradle.

It is preferable to make the installation area of the cradle to the floor surface is larger than the installation area of the image forming apparatus to be contained in the cradle.

15 It is preferable to arrange each mode of the image forming apparatuses described above to be thin having a thickness of three inches or less.

It is preferable to arrange for each mode of the image forming apparatuses described above image forming  
20 means serving as a recording head for forming images by discharging ink.

In accordance with the structures described above, it is possible to provide an image forming apparatus excellent in operability at the time of storing and  
25 charging battery with the full utilization of advantages such as thin and battery-driven preferably

suitable for portable use.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view that shows the entire  
5 structure of an ink jet printer, which is one  
embodiment of the image forming apparatus of the  
present invention.

Fig. 2 is a perspective view that shows the status  
of a battery charger being mounted on the ink jet  
10 printer represented in Fig. 1.

Fig. 3 is a perspective view that shows the ink  
jet printer represented in Fig. 1, which is in use.

Fig. 4 is a perspective view that shows the inner  
structure of the ink jet printer represented in Fig. 1  
15 entirely.

Fig. 5 is a perspective view that shows the cradle  
structure that contains the ink jet printer represented  
in Fig. 1.

Figs. 6A and 6B are enlarged perspective views  
20 that illustrate the operation of the shutter member of  
the cradle represented in Fig. 5.

Fig. 7 is a perspective view that shows the status  
where the ink jet printer having the battery charger  
mounted thereon as in Fig. 1 is contained in the  
25 cradle.

Fig. 8 is a perspective view that shows the



printer having the battery incorporated therein, which is contained in the cradle provided with charging means as another embodiment of the present invention, observed from the backside thereof.

5           Fig. 9 is a side view that shows the status where the ink jet printer having the battery charged mounted thereon as shown in Fig. 7 is contained in the cradle.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

10           Hereinafter, with reference to the accompanying drawings, the description will be made of the embodiments in accordance with the present invention.

          Fig. 1 is a perspective view that shows the entire structure of an image forming apparatus embodying the present invention. There are represented in it, the  
15   ink jet printer serving as an image forming apparatus, the battery charger, which is a charger detachably mountable on the printer main body, having a battery incorporated therein, and the cradle, which serves as  
20   the placement stand that contains both of them vertically when mounted. In this respect, the description is made using paper as a recording medium used for recording by this ink jet printer, for  
example. However, any type of medium may be usable if  
25   only the medium is of sheet type capable of being recorded.

In Fig. 1, the outer appearance of the ink jet printer 800 is a shell structure formed by an upper case 801, a lower case 802, a sheet-feeding cover 803, and a cover of sheet-expeller port 804, and then, the printer takes this mode when it is not in use (on the placement stand, being carried, or the like). Also, on the side face of the ink jet printer 800, there are arranged a DCin jack (the jack for use of DC supply source input) 817 where the AC adopter cable serving as the power supply source is inserted, and an I/F connector (interface connector) 815 for connecting USB cable. The sheet feeding cover 803 functions as the recording sheet-supplying tray on which recording sheet, such as paper, is stacked when the tray is open with respect to the printer main body for the execution of recording.

Fig. 3 is a perspective view observed from above on the right front side, and shows the statue of the printer main body 800, which is in use. In the status shown in Fig. 1, the sheet feeding opening portion 801a is covered by the sheet feeding cover 803, and also, the sheet expeller port 802a is covered by the sheet expeller port cover 804, respectively. In this status, it is arranged to prevent dust particles and foreign substances described earlier from entering the inside of the printer main body 800.

The sheet feeding cover 803 is made rotative centering on the rotational shaft 803a with respect to the printer main body 800, and by means of a stopper (not shown), it stops at a specific angle optimally  
5 given to feeding a sheet, and support the sheet feeding. In this manner, the precision of sheet feeding is enhanced. The sheet expeller port cover 804 rotates centering on the rotational shaft 804a and releases the sheet expeller port 802a.

10 Fig. 4 is a perspective view that shows the inner structure of the ink jet printer entirely.

In Fig. 4, the ink jet printer is structured with sheet material feeding means 101; sheet material conveying means 102; printing means 103; and recovering  
15 means 104.

The sheet material, which is stacked on a pressure plate 7 of sheet material feeding means 101 is let out and fed into conveying means 102 having a sheet-feeding roller rubber 10 provided therefor by use of a sheet-feeding roller 9 driven by a sheet-feeding motor 8.  
20 Further, the sheet material is conveyed onto to a platen 13 by the conveying roller 11, which is driven by the conveying motor 12 of conveying means 102.

On the sheet material conveyed onto the platen 13,  
25 printing is made by the printing head 2, which is mounted on the carriage 1 of printing means 103 having

ink tank 51 and 52 mounted thereon. The carriage 1 reciprocates along the guide shaft 4 with the driving power of the carriage motor 6, which is transmitted thereto by way of a carriage belt 5.

5           After printing is over, the sheet material is let out by the conveying roller 11 to a sheet expeller roller 15, and nipped between a spur 16 and the sheet-expeller roller to be expelled. The sheet-expeller roller 15 is driven by the driving power of the  
10   conveying motor 12, which is transmitted thereto by way of a sheet-expeller belt 14.

          Recovering means 104 is provided for the purpose of recovering the clogging of the printing head and others so as to maintain the printing status in good  
15   condition, which is structured with pumping means (not shown), capping means (not shown), and wiping means (not shown).

          Next, it is arranged to form a battery charger 900 with a main case 901, a cover case 902, and a battery  
20   903 to present the outer appearance thereof. The battery 903, which serves as the battery charger, is made removable.

          Also, on the installation surface (connecting surface) of the battery charger 900 to the ink jet  
25   printer 800, there are arranged the connector 904, which is used for electrical connection, and the fixing

screws 905 and 906, which are used for the mechanical installation and fixation. Then, with the connection of the printer main body in the direction indicated by an arrow A in Fig. 1, the battery driving is made possible. Further, on the ceiling face of the battery charger 900, a charge-indication unit 909 is arranged to indicate the charging condition of the battery. On the side face of the battery charge 900, there are arranged the CHG-DCin jack 907, into which is inserted the AC adopter cable that serves as the power supply, and a blind plate 908, which covers the DCin jack 817 of the ink jet printer 800 when the battery charger 900 is mounted.

The cradle 950 functions a placement stand when it is inserted in the direction indicated by an arrow B in Fig. 1 in the status where the battery charge 900 is mounted on the ink jet printer 800.

Fig. 2 is a perspective view that shows the status where the battery charge 900 is mounted on the ink jet printer 800 when the printer ceiling face side is observed from diagonally above, and also, from the backside of the printer.

As shown in Fig. 2, the battery charge 900 is mounted on the backside of the ink jet printer 800, and when fixed by use of the fixing screws 905 and 906, the battery driving is made possible.

Also, as described earlier, with the blind plate 908 provided for the battery charger 900, it is structure to cover the DCin jack 817 of the ink jet printer 800. Therefore, it is made possible for the user to insert the AC adopter cable into the CHG-DCin jack 907 side of the battery charger 900 without any errors when the battery charger 900 is mounted, thus preventing any erroneous insertion thereof.

On the backside of the battery charger 900, there are arranged four feet portions 901a, 901b, 901c, and 901d provided for the main case 901. Also, on the same backside, contacts 910a, 910b, and 910c are provided in order to effectuate electrical contacts when mounted on the cradle 950.

Further, as shown in Fig. 2, the charging indication unit 909 of the battery charger 900 is arranged in a position on the ceiling face easily recognizable when the ink jet printer 800 is mounted and used, and the recognition of eyesight thereof is not shielded when the sheet feeding cover 803 is open.

Fig. 5 is a perspective view that shows the structure of the cradle 950.

In Fig. 5, it is arranged to structure the cradle 950 with an upper case 951, a flowing member 952, a bottom case 953 (not shown in Fig. 5), and CDL ornamental plates 954 and 955 to present the outer

appearance thereof. On the outer circumferential side face of the upper case 951, there are arranged the CDL-DCin jack 956 for inserting the AC adopter cable serving as the power supply, and the windows 951a and 951b for making the eyesight recognition of the charging indication unit 909 possible for the battery charger 900 even when the printer is contained into the cradle 959.

Also, on the flooring member 952 inside the cradle 950, the CDL rubber feet 957 (in Fig. 5, three locations are not shown) that support the feet portions 901a, 901b, 901c, and 901d (Fig. 2) of the battery charger 900 are arranged to face each other when the ink jet printer 800 having the battery charge 900 mounted thereon is contained in the cradle. Further, inside the cradle 950, the contact terminals 958a, 958b, and 958c, which are electrically in contact with the contact points 910a, 910b, and 910c of the battery charger 900, and the shutter member 959 that protects them is arranged. The shutter member 959 usually ascends to the position where the tips of the contact terminals 958a, 958b, and 958c are hidden, and when the ink jet printer 800 having the battery charge 900 mounted thereon is contained in the cradle 950, the shutter member descends to the position where the tips of the contact terminals 958a, 958b, and 958c appear

(Fig. 5 shows the status in which the shutter member descends). In this respect, the number of contact points of the battery charger 900 and the number of the contact terminals of the cradle 950 are not necessarily  
5 limited to those of the present embodiment.

Further, as shown in Fig. 5, the contact points 910a, 910b, and 910c of the ink jet printer 800, and the contact terminals 958a, 958b, and 958c of the cradle 950 are arranged on the central portion of the  
10 contact surface between the ink jet printer 800 and the cradle 950, respectively. Then, the contact points 910a, 910b, and 910c, and the contact terminals 958a, 958b, and 958c are arranged with symmetrical relations so as to make the electrical connections in the correct  
15 arrangement thereof irrespective of the status whether the batter charger 900 is orientated forward or backward when it is contained in the cradle 950. Moreover, the windows 951a and 951b of the upper case 951 are arranged in the symmetrical positions for the  
20 charging indication unit 909 of the battery charger 900. As a result, the user can contain the ink jet printer 800 in the cradle 950 in the forward direction or backward direction without any functional drawback, and charging is made possible.

25 When the battery charger 900 is contained in the cradle 950 in a status where it is orientated forward



or backward, the contact point 910b is connected with the contact terminal 958b.

Also, the inside of the contact terminals 958a and 958c is conducted with the same polarity. Likewise,  
5 the contact points 910a and 910c are conducted. Therefore, being in contact with either the contact terminal 958a or 958c, the contact points 910a and 910c make correct connection.

Figs. 6A and 6B are enlarged perspective views  
10 that illustrate the operation of the shutter member 959 of the cradle 950. Fig. 6A shows the status where the shutter member 959 ascends. Fig. 6B shows the status where the shutter member 959 descends.

As shown in Fig. 6A, the shutter member 959  
15 ascends to the position to completely hide the contact terminals 958a, 958b, and 958c in the status where the cradle 950 does not contain anything, thus preventing these contact terminals from being broken or any other damages. When the ink jet printer 800 is contained in  
20 the cradle 950, the shutter member 959 descends so as to present the condition as shown in Fig. 6B, and the contact terminals 958a, 958b, and 958c are exposed from the slits 959a, 959b, and 959c provided for the shutter member 959, thus conditioning the contact points 910a,  
25 910b, and 910c to make electrical connection.

Also, the biasing force that enables the shutter

member 959 to ascends to the usual position is set at a value smaller than the weight of the single body of the battery charger 900, not to mention the ink jet printer 800. Therefore, even in a case where only the battery  
5 charger 900 is contained in the cradle 950, the structure is arranged so that the contact points 910a, 910b, and 910c can be electrically connected with the contact terminals 958a, 958b, and 958c.

Fig. 7 is a perspective view that shows the status  
10 where the ink jet printer 800 having the battery charge 900 mounted thereon is contained in the cradle 950.

In the status shown in Fig. 7, the contact points 910 of the aforesaid battery charger 900 and the contact terminals 958 of the cradle 950 are  
15 electrically connected. Therefore, when the AC adopter cable remains to be inserted into the CDL-DCin jack 956 of the cradle 950, the battery incorporated in the battery charger 900 is charged.

As shown in Fig. 7, in the status where the ink  
20 jet printer 800 is contained in the cradle 950, the upper case 951 is structured to cover the CHG-DCin jack 907 of the battery charger 900. As a result, the user can insert the AC adopter cable into the CDL-DCin jack 956 side of the cradle 950 correctly when the cradle  
25 950 is used, thus preventing any erroneous insertion thereof.

Also, the charging indication unit 909 of the battery charger 900 is structured to be visible through the window 951a provided for the upper case 951 of the cradle 950. Consequently, it is possible to confirm  
5 the charged condition of the battery as it is contained in the cradle 950.

Also, Fig. 9 is a side view that shows the ink jet printer 800 contained in the cradle 950 with the battery charger 900 mounted thereon as shown in Fig. 7.

10 As shown in Fig. 9, in the status where the ink jet printer 800 is contained in the cradle 950, the structure is arranged to support it in a position where the sheet-feeding cover 803 is not released. In other words, when the ink jet printer 800 is contained in the  
15 cradle 950, the sheet-feeding cover 803 is placed inside the upper case 951 of the cradle 950 so as to regulate the open and closing operation of the sheet-feeding cover 803. Therefore, it becomes possible to prevent the sheet-feeding cover 803 from being open or  
20 falling off erroneously during the charging of battery or the like.

Also, in Fig. 9, the upper case 951 and the CDL ornamental plate 954 are structured so as to enable the I/F connector 815 of the ink jet printer 800 to be  
25 completely exposed in the status where it is contained in the cradle 950. Therefore, even if the USB cable is

inserted into the ink jet printer 800, which is  
contained in the cradle 950 as it is, there is no  
interference between the cradle 950 and the cable, and  
it is unnecessary to remove the USB cable at each time  
5 when the printer is contained. There is no possibility  
that the connector portions are damaged, either. In  
this respect, it may be possible to use a printer  
having wireless communication means, such as light or  
electric waves, provided therefor in a location where  
10 such means is exposed from the cradle 950 when the ink  
jet printer 800 of the kind is contained.

Further, as shown in Fig. 9, The shape of the  
cradle 950 is formed so that the relations between the  
width X of the opening portion that receives the ink  
15 jet printer 800 (that is, the width of installation  
surface of the ink jet printer 800 when it is placed  
vertically), and the width Y of the installation  
surface of the cradle 950 to the floor surface are made  
to be  $X < Y$ . As a result, as compared with the case  
20 where the ink jet printer 800 is placed vertically  
alone, the stability becomes far greater when it is  
vertically placed after being contained in the cradle  
950. Therefore, there is no need any longer for  
careful handling when it is placed vertically by itself  
25 or no need for expanding or holding the foot member by  
some other action for obtaining the expanded

installation area in order to secure stability, and the attachment and detachment are made with ease.

In accordance with the embodiment so far, the description has been made of the structure in which it is made possible to charge a battery by containing in a cradle having only energizing function a charging device attachable to and detachable from the printer main body having the battery incorporated therein, and an ink jet printer having the charging device mounted thereon. However, the present invention is not necessarily limited to such structure.

In other words, as another embodiment, it may be possible arrange the structure so that a printer having a battery incorporated therein is contained in a cradle having charging means therefor. Further, it may be possible to arrange the structure so that a printer having a battery and charging means incorporated therein is contained in a cradle having only energizing function therefor.

Fig. 8 is a perspective view that shows the printer in accordance with another embodiment described above, observed diagonally above from the printer backside and printer ceiling face side as well.

As shown in Fig. 8, on the backside of the ink jet printer 800, there is arranged the contact point portion 910 of the cradle 950 for making electrical

connection with the contact terminal portion 958.  
Then, the ink jet printer 800 having a battery (not  
shown) incorporated therein is directly contained in  
the cradle 950, which is provided with charging means  
5 (the same structure as shown in Fig. 5). In this  
manner, it becomes possible to charge the aforesaid  
battery. Also, the structure is arranged so as to make  
it possible to recognize by eyesight the charging  
indication unit 909 on the backside of the ceiling face  
10 of the ink jet printer 800 through the window 951a  
provided for the upper case 951 of the cradle 950, thus  
recognizing the charging condition of the battery while  
the ink jet printer 800 is contained in the cradle 950  
as it is. Further, when the user contains the ink jet  
15 printer 800 in the cradle 950 in any direction, forward  
or backward, it is made possible to recognize the  
charging indication unit 909 through the window 951a,  
and to electrically connect the contact point portion  
910 on the backside of the ink jet printer 800 with the  
20 contact terminal portion 958 of the cradle 950. Also,  
in place of the ink jet printer having the battery  
incorporated therein, the structure may be arranged to  
use an ink jet printer having a battery and charging  
means incorporated therein. Even in this case, the  
25 printer structure is the same as Fig. 8, and the  
structure of the cradle that contains such printer is

the same as Fig. 5.

Further, for this printer of another embodiment, it is of course possible to adopt appropriately the structure described in conjunction with Fig. 1 to Fig. 7, and Fig. 9 before the description of such another embodiment.

Also, as obvious from the descriptions that have been made so far, the present invention is particularly preferable for a thin type image forming apparatus having a thickness of 3 inches or less, which demonstrates excellent portability but lacks stability when it is placed vertically.

As described above, in accordance with the present invention, it is possible to provide an image forming apparatus, which can be used in a mode of horizontal placement when images are formed, and also, in a mode of vertical placement with the aforesaid container stand having the apparatus contained therein when it is not in use. Further, it is made possible to charge the image forming apparatus in the status where it is contained in the container stand. Therefore, it is made possible to provide the image forming apparatus excellent in operability at the time of storage and charging battery as well, in addition to the advantages that it is thin and battery-driven, and suitable for portable use.